

Fusobacterium infections in children

Karen Arane MSc Ran D. Goldman MD FRCPC

Abstract

Question A 2-year-old patient in my practice with acute otitis media that has progressed to mastoiditis with a high fever returns with positive culture results for *Fusobacterium*. What should I do next?

Answer *Fusobacterium* is a genus of anaerobic bacteria. Although *Fusobacterium* infections are rare, they can become severe if not treated promptly. Appropriate treatment is combination antibiotic therapy consisting of a β -lactam (penicillin, cephalosporin) and an anaerobic antimicrobial agent (metronidazole, clindamycin). At times surgical involvement is required for mastoiditis such as drainage of abscesses or insertion of a ventilation tube. Delayed treatment of an infection caused by *Fusobacterium* can lead to serious complications, including Lemierre syndrome. Children should be seen in a hospital for close monitoring.



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Fusobacterium is a family of obligate anaerobic Gram-negative bacilli that comprise the normal flora of the oral cavity, gastrointestinal tract, and female genital tract. As early as 1936, André Lemierre associated *Fusobacterium* infections with thrombophlebitis of the jugular vein.¹ More recently the incidence of *Fusobacterium* infections has increased. Although the reason for this increase is unknown, theories related to decreases in antibiotic use and improved detection techniques might account for the change.²⁻⁵ It is crucial that clinicians can detect the early signs of *Fusobacterium* infection, as a series of complications, such as Lemierre syndrome (postanginal sepsis), bacteremia, osteomyelitis, and septic shock, can quickly arise.⁶

Clinical characteristics

Fusobacterium infections in the pediatric population primarily affect the head and neck region, as the bacteria predominantly reside within the oral cavity. Acute otitis media is the most common site of infection, especially among children 2 years of age and younger.^{3,4,6,7} In immunocompetent patients, incidence is equal among males and females.^{3,7} Initial symptoms include fever (38°C to 39°C) with acute otitis media that has often progressed to mastoiditis. Laboratory evaluation reveals elevated inflammatory markers: C-reactive protein level, white blood cell count, and absolute neutrophil count.^{3,4,6-9} Mastoiditis is diagnosed with clinical and otoscopic evidence of swelling, erythema, and tenderness of the retroauricular area or displacement of the auricle antero-inferiorly.^{3,4,8} Megged et al⁷ focused on neurologic manifestations of *Fusobacterium* infections among 27 children with a median age of 3.5 years and found that 5 of them

presented with decreased levels of consciousness and 7 had seizures before treatment was initiated.

Anaerobic bacteria cause less than 1% of middle ear infections; however, if left untreated serious complications such as subperiosteal and epidural abscesses might occur.^{4,6} Bacteremia is a severe complication that commonly arises and has been seen in up to 77% of *Fusobacterium* cases in children, potentially caused by the proximity of intracranial sinuses to the mastoid bone.^{6,8} Osteomyelitis was also observed in 40% of patients and often was multifocal, requiring prolonged intravenous antibiotic therapy.^{4,6} Meningitis caused by *Fusobacterium* is rare and has been described fewer than 20 times; however, it is often noted to cause severe morbidity and mortality.^{7,10}

It has been suggested that owing to immunological immaturity in young age, development of Lemierre or Lemierre-like syndrome commonly occurs following middle ear infections with *Fusobacterium*.⁶ This is caused by an extension of middle ear infection into a venous sinus thrombosis. Lemierre syndrome is a serious complication of *Fusobacterium* infection, and in a study of 12 patients with the infection, 58% developed Lemierre or Lemierre-like syndrome.⁶ The syndrome is characterized by internal jugular vein septic thrombophlebitis or thrombosis and can cause septic embolic lesions in the lungs or other sterile sites.¹¹

Diagnosis

Before confirmatory culture results are completed, clinical characteristics are important to consider in the diagnosis of *Fusobacterium* infection. For patients younger than age 3 with suspected *Fusobacterium*

infection, clinical characteristics include high fever, a toxic appearance, and increased inflammatory markers. Mastoid involvement is common and can be diagnosed with a computed tomographic scan.

Confirmatory diagnosis is often done by blood or tissue culture. Anaerobic cultures tend to be more difficult to grow and previous antibiotic use can yield false-negative results.⁹ Polymerase chain reaction assay is a simple, quick, and quantitative detection technique that can identify levels much lower than cell culture; however, its cost prevents widespread use of the assay as a diagnostic tool.^{2,9}

Treatment

The severity and spread of *Fusobacterium* determines the extent of treatment needed. All *Fusobacterium* infections must be treated with antibiotics and are generally susceptible to β -lactams such as penicillin or cephalosporin or their derivatives.¹² A few strains of *Fusobacterium* were found to have β -lactamase enzymes, and therefore it is recommended to include a specific anaerobic antibiotic such as metronidazole or clindamycin.^{4,6} Antibiotic treatment is often administered parenterally for 1 to 2 weeks followed by approximately 10 days of oral treatment.^{3,6-9} Some children will need removal of necrotic tissue or surgical drainage.^{3,4,6,9}

In a surveillance study of 7 patients younger than 2.2 years of age with *Fusobacterium* infection, all required a ventilation tube in addition to mastoidectomy.⁴ In a 14-year study from Israel with 22 children with *Fusobacterium* infection, 3 of the 5 patients who developed Lemierre syndrome were treated with low-molecular-weight heparin to alleviate symptoms of a cerebral sinus venous thrombosis⁸—treatment that is still considered controversial.^{3,6}

A 40-year literature review by Stergiopoulou et al⁶ identified 12 cases of *Fusobacterium* infections in children younger than age 2; all the children developed mastoiditis and underwent mastoidectomy and antibiotic treatment, which led to successful outcomes, regardless of severity. The combination of appropriate antibiotic treatment with surgical debridement was shown to prevent complications. In a retrospective study by Shamriz et al,⁸ of the 22 patients analyzed there was only 1 patient who had a fatal outcome from overwhelming sepsis and all other patients fully recovered after treatment. While a mortality rate of up to 40% of *Fusobacterium* infections has been reported, early detection and proper treatment can effectively halt and reverse the progression of infection.^{9,13}

Conclusion

Fusobacterium infection can clinically present as acute otitis media in children 2 years of age and younger, but if left untreated it will progress to mastoiditis and more severe symptoms of bacteremia, osteomyelitis, and potentially

Lemierre syndrome and septic shock. The use of proper antimicrobial detection techniques along with the appropriate imaging procedures should allow for the prompt use of antibiotics and surgical involvement to prevent further dissemination of the infection. While research and analysis on *Fusobacterium* infections is limited, important awareness of symptomatology and severity of the infection can help clinicians detect early onset of infections and direct patients to appropriate specialists.

Competing interests

None declared

Correspondence

Dr Ran D. Goldman; e-mail rgoldman@cw.bc.ca

References

1. Riordan T. Human infection with *Fusobacterium necrophorum* (Necrobacillosis), with a focus on Lemierre's syndrome. *Clin Microbiol Rev* 2007;20(4):622-59.
2. Aliyu SH, Marriott RK, Curran MD, Parmar S, Bentley N, Brown NM, et al. Real-time PCR investigation into the importance of *Fusobacterium necrophorum* as a cause of acute pharyngitis in general practice. *J Med Microbiol* 2004;53(Pt 10):1029-35.
3. Le Monnier A, Jamet A, Carbonnelle E, Barthod G, Moumille K, Lesage F, et al. *Fusobacterium necrophorum* middle ear infections in children and related complications: report of 25 cases and literature review. *Pediatr Infect Dis J* 2008;27(7):613-7.
4. Yarden-Bilavsky H, Raveh E, Livni G, Scheuerman O, Amir J, Bilavsky E. *Fusobacterium necrophorum* mastoiditis in children—emerging pathogen in an old disease. *Int J Pediatr Otorhinolaryngol* 2013;77(1):92-6. Epub 2012 Oct 25.
5. Brook I. *Fusobacterium* infections in children. *Curr Infect Dis Rep* 2013;15(3):288-94.
6. Stergiopoulou T, Walsh TJ. *Fusobacterium necrophorum* otitis and mastoiditis in infants and young toddlers. *Eur J Clin Microbiol Infect Dis* 2016;35(5):735-40. Epub 2016 Mar 7.
7. Megged O, Assous MV, Miskin H, Peleg U, Schlesinger Y. Neurologic manifestations of *Fusobacterium* infections in children. *Eur J Pediatr* 2013;172(1):77-83. Epub 2012 Sep 27.
8. Shamriz O, Engelhard D, Temper V, Revel-Vilk S, Benenson S, Brooks R, et al. Infections caused by *Fusobacterium* in children: a 14-year single-center experience. *Infection* 2015;43(6):663-70. Epub 2015 May 1.
9. Bailhache M, Mariani-Kurkdjian P, Lehours P, Sarlangue J, Pillet P, Bingen E, et al. *Fusobacterium* invasive infections in children: a retrospective study in two French tertiary care centres. *Eur J Clin Microbiol Infect Dis* 2013;32(8):1041-7. Epub 2013 Mar 8.
10. Figueras G, Garcia O, Vall O, Massaguer X, Salvado M. Otogenic *Fusobacterium necrophorum* meningitis in children. *Pediatr Infect Dis J* 1995;14(7):627-8.
11. Kimberlin D, editor. *Fusobacterium* infections. In: Committee on Infectious Diseases; American Academy of Pediatrics. *Red book*. Elk Grove Village, IL: American Academy of Pediatrics; 2015. p. 351-2.
12. Brook I. *Fusobacterium* infections in children. *J Infect* 1994;28(2):155-65.
13. Creemers-Schild D, Gronthoud F, Spanjaard L, Visser LG, Brouwer CN, Kuijper EJ. *Fusobacterium necrophorum*, an emerging pathogen of otogenic and paranasal infections? *New Microbes New Infect* 2014;2(3):52-7. Epub 2014 Mar 25.



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